BIOTA AMAZÔNIA

ARTICLE

DOI: http://dx.doi.org/10.18561/2179-5746/biotaamazonia.v11n1p22-28

Rapid survey of the herpetofauna of Estação Ecológica Alto Maués: a rarely accessed area in the Brazilian Amazonia

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ABSTRACT

Amazonia represents one of the most diverse biomes in the world, but a large part of the region remains under-sampled. Here, I present a preliminary checklist of amphibians and reptiles from Estação Ecológica Alto Maués (ESEC Alto Maués), Maués municipality, Amazonas State, Brazil. During a 14-day period (4-18 May 2019), I conducted visual and acoustic surveys and obtained opportunistic records within the ESEC Alto Maués area. A total of 141 specimens were recorded, belonging to 19 anuran and 17 reptile species in ten and eight taxonomic families, respectively. I also compared the diversity at ESEC Alto Maués with other areas throughout Brazilian Amazonia, and provide new occurrence records (*Boana icamiaba* and *Adelphobates* aff. *quinquevittatus*) for the region.

Keywords*:* Amazonia; biodiversity; checklist; herpetofauna; new record.

Levantamento rápido da herpetofauna da Estação Ecológica Alto Maués: uma área raramente acessada na Amazônia brasileira

RESUMO

A Amazônia representa um dos biomas mais diversos do mundo, mas uma grande parte da região permanece sub-amostrada. Aqui, apresento uma lista preliminar de anfíbios e répteis da Estação Ecológica Alto Maués (ESEC Alto Maués), município de Maués, Estado do Amazonas, Brasil. Durante um período de 14 dias (4-18 de maio de 2019), realizei levantamentos visuais e acústicas e obtive registros oportunistas na área da ESEC Alto Maués. Um total de 141 espécimes foram registrados, pertencentes a 19 espécies de anuros e 17 espécies de répteis em dez e oito famílias taxonômicas, respectivamente. Eu também comparei a diversidade na ESEC Alto Maués com outras áreas da Amazônia brasileira, e forneci novos registros de ocorrência (*Boana icamiaba* e *Adelphobates* aff. *quinquevittatus*) para a região.

Palavras-chave: Amazônia, biodiversidade, checklist, herpetofauna, novos registros.

Introduction

Brazil has the greatest amphibian richness of the world, with 1137 known species (SEGALLA et al., 2019), and lies third for richness in reptiles with 795 known species (COSTA; BÉRNILS, 2018). Many of these species occur in the Brazilian Amazonia (332 amphibian species and 346 reptile species; FONSECA et al., 2019). Amazonia is considered the world's largest and most diverse tropical forest, having one of the highest levels of biodiversity on Earth and provide important ecosystem services such as climate regulation and carbon storage (MYERS et al., 2000; LEWINSOHN; PRADO, 2005; COE et al., 2013). However, knowledge of its biodiversity is patchy, and much of the region remains under-sampled (FUNK et al., 2011; ÁVILA-PIRES et al., 2007). Among the various under-sampled groups that require more attention are amphibians and reptiles (AZEVEDO-RAMOS; GALATTI, 2002; ÁVILA-PIRES et al., 2010).

Several reasons have been given for the scarcity of studies on Amazonian biodiversity, including its large size and difficulties of access, so that the majority of inventories have been concentrated in the most accessible regions, where most researchers and logistic resources also reside (AZEVEDO-RAMOS, 1998; AZEVEDO-RAMOS; GALATTI, 2002; ÁVILA-PIRES et al., 2010; FRAZÃO et al., 2020). It is, therefore, difficult to estimate the true richness of amphibians and reptiles in the Brazilian Amazonia given the difficulties in accessing even such basic information (AZEVEDO-RAMOS; GALATTI, 2002; ÁVILA-PIRES et al., 2007; BERNARDE et al., 2011). Other indications that we are still a long way from a realistic estimate of true Amazonian herpetological diversity include the constant new occurrence records (e.g., CARVALHO et al., 2017; VENÂNCIO et al., 2017; FONSECA et al., 2019), the large number of recently described species (e.g., FERRÃO et al., 2018; MELO-SAMPAIO et al., 2018; PELOSO et al., 2018; KAEFER et al., 2019; MORAES et al., 2019; PASSOS et al., 2019; SIMÕES et al., 2019), discovery of candidate species (e.g., FERRÃO et al., 2016; FERREIRA et al., 2017; MORAES et al., 2017) and taxonomic problems (FUNK et al., 2011).

This overall lack of knowledge concerning the taxonomy and biogeography of amphibians and reptiles in the Brazilian Amazonia also makes it difficult to assign valid conservation statuses to species in this region (CAMPOS et al., 2014). Animals in these groups are particularly sensitive to environmental degradation (see NAVAS; OTANI, 2007; SINERVO et al., 2010; BÖHM et al., 2013; MENIN et al., 2019), and about 32% of amphibian species and 19% (range: 15-36%) of reptiles worldwide are threatened (Vulnerable, Endangered or Critically Endangered) (STUART et al., 2004; 2008; BÖHM et al., 2013), including 41 and 85 species of anurans and reptiles in Brazil, respectively (ICMBio, 2018). Thus, fauna surveys are particularly important in order to understanding of the species present in an area and generate basic knowledge of patterns of regional diversity and spatial distribution, thus serving as a basis for further studies and the development of effective conservation policies within the Brazilian Amazonia (VERDADE et al., 2012; MIRANDA et al., 2014; FONSECA et al., 2019; FRAZÃO et al., 2020).

Among the proposed Areas of Endemism for Brazilian Amazonia (CRACRAFT, 1985; SILVA et al., 2002), the region between the Madeira and Tapajós rivers lies within the Area of Endemism of Rondônia (RAE; about 675,454 km^2). There is a large information gap in this region, which is widely considered one of the most threatened and least scientifically explored areas (SILVA et al., 2002; COHN-HALF et al., 2007; FERNANDES, 2013, FERREIRA et al., 2017). To protect regional biodiversity, several protected areas have been created in the region, though are most are poorly-known (SILVA et al., 2005; MMA, 2020). Accordingly, to enhance both general and local knowledge, surveys were conducted on one of the most isolated and poorly studied area, the Estação Ecológica Alto Maués (ESEC Alto Maués), Maués municipality, 280 km from Manaus, Amazonas State, northern Brazil.

In May 2019, I surveyed amphibians and reptiles at ESEC Alto Maués as part of a multidisciplinary biological diversity inventory organized by the government agency Chico Mendes Institute for Biodiversity Conservation - ICMBio. Here, I provide the first checklist of amphibians and reptiles from ESEC Alto Maués, indicate its conservation status and compare the herpetofaunal richness of this region with that of other areas throughout Brazilian Amazonia. Additionally, I comment on two new occurrences of amphibian species to ESEC Alto Maués. Those results may aid future studies and help in determining priority areas for new inventories with recommendations for research to support better herpetological diversity understanding in this region.

Material and Methods

Study area

The ESEC Alto Maués (Figures 1 and 2) is a federally protected area officially established on October 16, 2014, and located on the eastern boundary of Rondônia area of endemism, delimited by the Madeira and Tapajós rivers and covering a total of 665,673 hectares (CRACRAFT, 1985; SILVA et al., 2002; MMA, 2020). Large rivers in its basin include the Abacaxis, Curauai, Parauari, Pucu, Pupunha and Maués-Açú, while the regional forest, especially during the wet season, is drained by numerous small streams, some fast-flowing and others barely moving. The climate in the area is typical of tropical forest: moist to very moist (Equatorial, Subtype Am, according to KÖPPEN, 1918), with a mean annual temperature of 27°C, varying between 10 and 38°C. It rains throughout the year in the ESEC Alto Maués region, with an average annual precipitation of approximately 2,600 mm, and constant occurrences of positive or negative anomalies in relation to normal climatological precipitation (SANTOS, 2019; INMET, 2020). According to the historical series of the Maués region (1985-2014), rainy season occurs from December to May (with peak in March; 372,1 mm) and dry season from September to November (with peak in September; 84 mm). The months of June to August are months of transition between the regimes (FISCH et al., 1998; SANTOS, 2019). Vegetation consists of a transition between the Amazon lowlands and montane forest (ICMBio, 2020). The predominant vegetation type (78% of the area) is classified as Dense Submontane Ombrophilous Forest with Emergent Canopy (ICMBio, 2020). Other formations are also present, but in smaller proportions, these being Dense Ombrophilous Submontane Forest with Uniform Canopy (7%), Dense Ombrophilous Forest with Alluvial Canopy (3%), Submontane Open Ombrophilous Forest with lianas (2%) and Dense Ombrophilous Forest Lowlands with Emerging Canopy (1%).

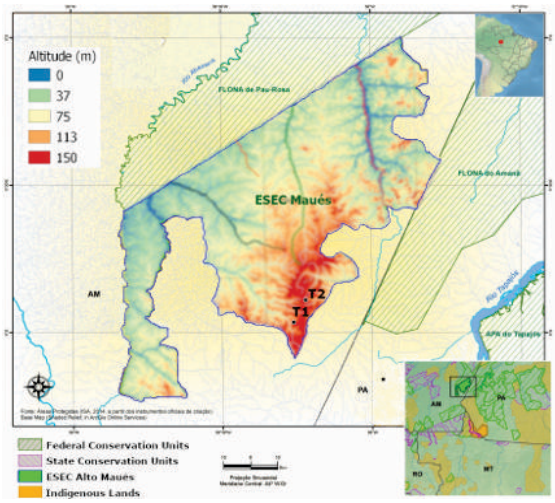

Figure 1. Study area showing transects locations (T1 e T2), and the location and limits of ESEC Alto Maués, in the municipality of Maués, state of Amazonas, Brazil. Currently, the ESEC Alto Maués is surrounded by two protected areas: the Floresta Nacional do Pau-Rosa (827,877 ha) and the Floresta Nacional do Amanã (682,561 ha).

Collection and analysis of data

Specimens were observed and collected between 4-18 May 2019 on two transects, each consisting of a 5 km long trail, with starting points 5 km apart (transect 1- 05°35'53.3" S, 058°49'07.0" W and transect 2- 05°40'33.4" S, 058°49'51.6" W, WGS84), as well as opportunistic records (OR). I sampled specimens using time-constrained visual encounter surveys (VES) and auditory search (AS) (CAMPBELL; CHRISTMAN, 1982; CRUMP; SCOTT, 1994). Transects were surveyed for a duration of 240 min, with studies conducted during the day (7:00-10:00 and 14:00-17:00), at dusk (17:30-18:30) and at night (19:00-23:00), totaling 180 sampling hours, always by one researcher accompanied by a field assistant for security. VES consists of walking very slowly along forest trails carefully searching for animals and inspecting potentially suitable microhabitats for amphibians and reptiles (e.g., on the ground, on tree trunks, branches and shubs, under and on fallen trunks, twigs, roots, leaf litter and stones, rotholes, inside bromeliads, treeholes and on trees and herbaceous vegetation (see DODD, 2010). In addition, some aquatic environments such as temporary and permanent ponds, shallow rivulets and streams were also searched. The survey was conducted in the Dense Submontane Ombrophilous Forest with Emergent Canopy.

Collected specimens were euthanized with a lethal dose of 7.5% to 20% lidocaine, following approved protocols, then fixed in 10% formalin and stored in 70% ethanol. I also collected tissue samples from all collected specimens that were preserved in 96% ethanol. Each specimen received a unique field identification number (acronym – APL; Supplementary material S1). All voucher specimens and tissue subsamples were deposited in the Population Ecology Laboratory, National Institute for Amazon Research (INPA), with the latter housed in the herpetological collection of the INPA, Manaus, state of Amazonas, Brazil. Voucher numbers of the collection material appear in the Supplementary Material (Supplementary material S1), except for *Allobates femoralis* (BOULENGER, 1884) that I was not able to catch. Collection permits were provided by ICMBio (License N°. 69572-1 – SISBIO).

Specimens were identified using recent taxonomic keys, original descriptions, photographs available in the specialized literature (e.g., ÁVILA-PIRES, 1995; PYRON et al., 2013, FROST, 2020), and personal experience (e.g., common and well known species by the researcher in question and/or his research group). To check the conservation status of the species, I consulted the Official National List of threatened Species (ICMBio, 2018). Taxonomic nomenclature for the amphibian and reptile species followed the List of Amphibians and Reptiles organized by SEGALLA et al. (2019) and COSTA; BÉRNILS (2018), respectively.

To estimate the efficiency of collection effort in the area, I used species accumulation curves constructed independently for reptiles and amphibians (Figure 3). The curves were based on each day of sampling as a sample, totaling 14 samples for analysis. Mean curve and confidence intervals (95%) were calculated based on 100 permutations. For this, I used the *specaccum* function of the R package Vegan v. 2.5.5 (OKSANEN et al., 2019) in the R platform R 3.5.2 (R Core Team, 2018).

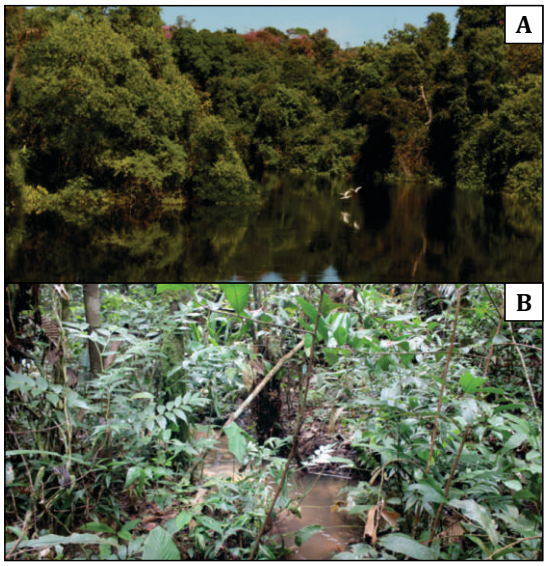

Figure 2. Landscapes at ESEC Alto Maués, municipality of Maués, Amazonas, Brazil. **A**. Panoramic view of the general habitat. **B**. Forest interior. Photos by Anthony Ferreira.

Results

Over a total of 180 hours, I recorded a total of 141 individuals, belonging to 19 anuran species in 12 genera and eight families (Figures 4-6), and seventeen reptile species were recorded in 15 genera and 10 families (Figures 7 and 8). The most well-represented anuran family was Hylidae (six species: 31%), Gymnophthalmidae for lizards (three species: 37%), and Colubridae for snakes (three species: 50%). Seven taxa were undetermined at the species level (all frogs), this was due to taxonomic uncertainties (e.g., inconsistencies in the taxonomy concerning a given group and/or insufficient material collected). The complete list of sampled species is given in Tables 1 and 2 (anurans and reptiles, respectively).

Table 1. List of species of anurans recorded from ESEC Alto Maués, Maués municipality, Amazonas State, Brazil. VES = visual encounter surveys; AS = auditory search OR = opportunistic records; LC = least-concern; NA = no data available.

Taxon	Sampling Method	Figure	Conservation status
ORDER ANURA			
AROMOBATIDAE			
Allobates femoralis (Boulenger 1884)	AS	4A	LC
Allobates grillisimilis Simões et al. 2014	VES; AS; OR	4B	
BUFONIDAE			
Amazophrynella aff. *vote* Ávila et al. 2012	VES; AS; OR	4C	LC
Rhinella gr. *margaritifera* sp.1	VES	4D	
Rhinella gr. *margaritifera* sp.2	VES; OR	4E	
CRAUGASTORIDAE			
Pristimantis aff. *fenestratus* (Steindachner 1864)	OR	4F	LC
Pristimantis sp.	VES	5A	
DENDROBATIDAE			
Adelphobates aff. *quinquevittatus* (Steindachner 1864)	VES	5B	LC
ELEUTHERODACTYLIDAE			
Phyzelaphryne miriamae Heyer 1977	VES; AS	5C	LC
HYLIDAE			
Boana icamiaba Peloso et al. 2018	VES	5D	NA
Boana leucocheila (Caramaschi and Niemeyer 2003)	VES	5E	LC
Dendropsophus ozzyi Orrico et al. 2014	VES	5F	NA
Osteocephalus gr. *leprieurii* (Duméril and Bicron 1841)	VES	-	LC
Osteocephalus oophagus Jungfer and Schiesari 1995	VES; AS	6A	LC
Osteocephalus taurinus Steindachner 1862	VES; AS	6B	LC
LEPTODACTYLIDAE			
Adenomera andreae (Müller 1923)	VES; AS; OR	6C	LC
Leptodactylus mystaceus (Spix 1824)	VES; OR	6D	LC
Leptodactylus pentadactylus (Laurenti 1768)	OR	6E	LC
MICROHYLIDAE			
Chiasmocleis hudsoni Parker 1940	VES; AS	6F	LC

Table 2. List of species of Reptilia (Crocodylia, Squamata and Testudinata) recorded from ESEC Alto Maués, Maués municipality, Amazonas State, Brazil. VES = visual encounter surveys; OR = opportunistic records; LC = least-concern; NA = no data available.

Taxon	Sampling Method	Figure	Conservation status
ORDER CROCODILIA			
ALLIGATORIDAE			
Paleosuchus trigonatus Schneider 1801	VES	7A	LC
ORDER SQUAMATA (LIZARDS)			
GYMNOPHTHALMIDAE			
Arthrosaura reticulata (O'Shaughnessy 1881)	VES	7B	LC
Cercosaura anordosquama Sturaro et al. 2018	VES; OR	7C	NA
Loxopholis osvaldoi (Avila-Pires 1995)	VES; OR	7D	LC
POLYCHROTIDAE			
Norops tandai (Avila-Pires 1995)	VES; OR	7E	LC
TEIIDAE			
Kentropyx calcarata Spix 1825	VES; OR	7F	LC
SCINCIDAE			
Copeoglossum nigropunctatum (Spix 1825)	VES	7G	LC
SPHAERODACTYLIDAE			
Gonatodes humeralis (Guichenot 1855)	VES	7H	LC
Chatogekko amazonicus (Andersson 1918)	VES; OR	7I	LC
ORDER SQUAMATA (SNAKES)			
BOIDAE			
Corallus batesii (Gray 1860)	VES	8A	LC
COLUBRIDAE			
Erythrolamprus oligolepis (Boulenger 1905)	VES	8B	LC
Imantodes cenchoa (Linnaeus 1758)	VES	8C	LC
Thamnodynastes pallidus (Linnaeus 1758)	VES	8D	LC
VIPERIDAE			
Bothrops atrox (Linnaeus 1758)	VES; OR	8E	LC
Bothrops taeniatus Wagler 1824	VES	8F	LC
ORDER TESTUDINES (TORTOISES)			
TESTUDINIDAE			
Chelonoidis carbonarius (Spix 1824)	VES	8G	LC
Chelonoidis denticulatus (Linnaeus 1766)	VES	8H	LC

The species accumulation curves for both anurans and reptiles did not reach an asymptote (following an upward trend), indicating that the inventory is incomplete. More sampling is needed to provide additional effort to survey the ESEC Alto Maués herpetofauna (Figure 3).

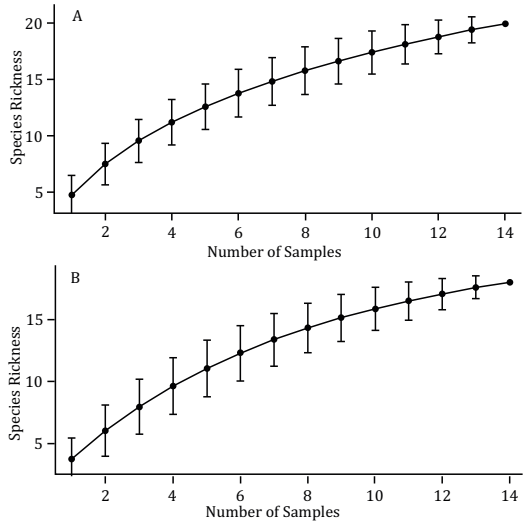

Figure 3. **A**. Species accumulated curves for amphibians and **B**. Reptiles recorded at ESEC Alto Manués, AM. The center line represents the mean accumulation curve, while the associated vertical bars represent the confidence intervals (95%) after 100 permutations.

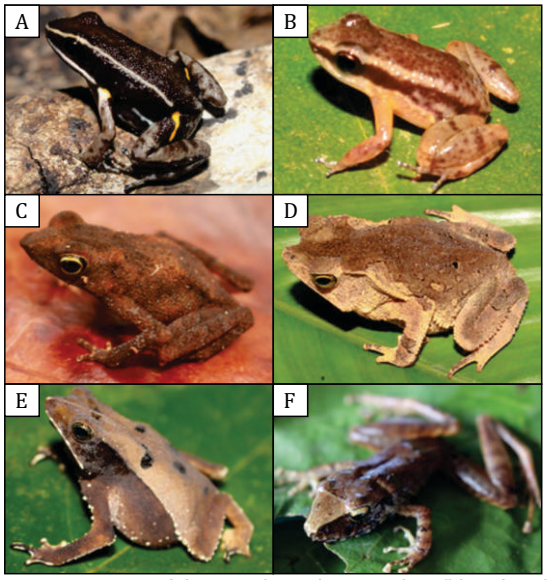

Figure 4. Anuran species recorded at ESEC Alto Maués, AM, Brazil. **A**. *Allobates femoralis*. **B**. *Allobates grillisimilis*. **C**. *Amazophrynella aff. vote*. **D**. *Rhinella* gr. *margaritifera* sp.1. **E**. *Rhinella* gr. *margaritifera* sp.2. **F**. *Pristimantis* aff. *fenestratus*. Photos by Anthony Ferreira.

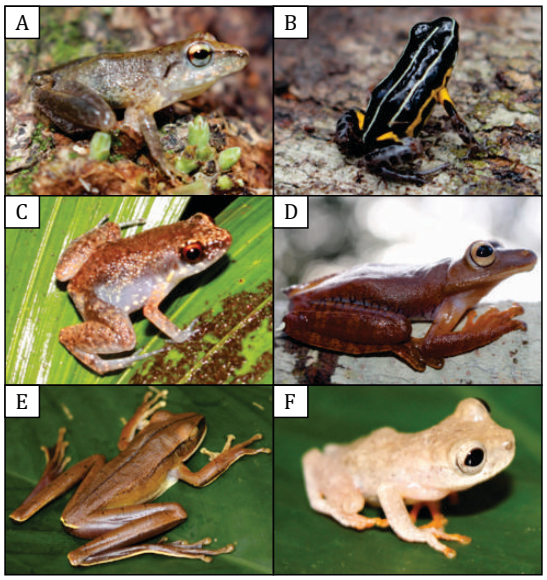

Figure 5. Anuran species recorded at ESEC Alto Maués, AM, Brazil. **A**. *Pristimantis* sp. **B**. *Adelphobates* aff. *quinquevittatus*. **C**. *Phyzelaphryne miriamae*. **D**. *Boana icamiaba*. **E**. *Boana leucocheila*. **F**. *Dendropsophus ozzyi*. Photos by Anthony Ferreira.

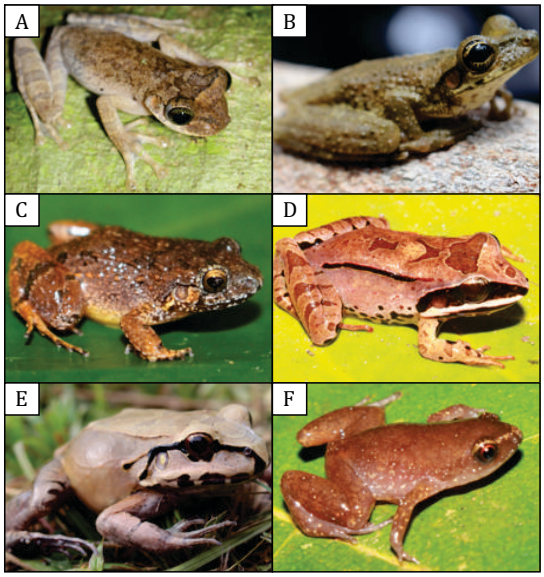

Figure 6. Anuran species recorded at ESEC Alto Maués, AM, Brazil. **A**. *Osteocephalus oophagus*. **B**. *Osteocephalus taurinus*. **C**. *Adenomera andreae*. **D**. *Leptodactylus mystaceus*. **E**. *Leptodactylus pentadactylus*. **F**. *Chiasmocleis hudsoni*. Photos by Anthony Ferreira.

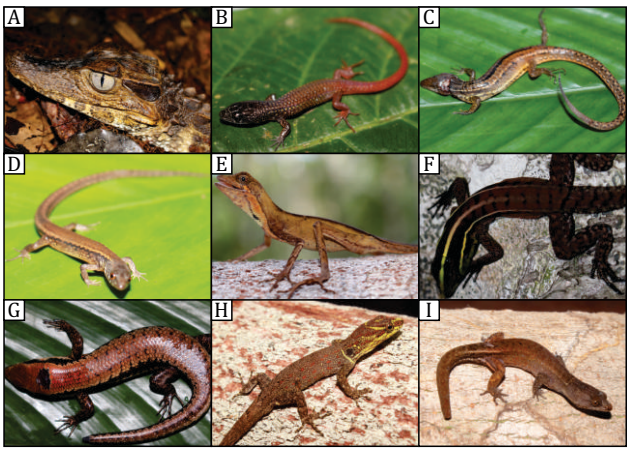

Figure 7. Reptile species recorded at ESEC Alto Maués, AM, Brazil. **A**. *Paleosuchus trigonatus*. **B**. *Arthrosaura reticulata*. **C**. *Cercosaura anordosquama*. **D**. *Loxopholis osvaldoi*. **E**. *Norops tandai*. **F**. *Kentropyx calcarata* **G**. *Copeoglossum nigropunctatum*. **H**. *Gonatodes humeralis*. **I**. *Chatogekko amazonicus*. Photos by Anthony Ferreira.

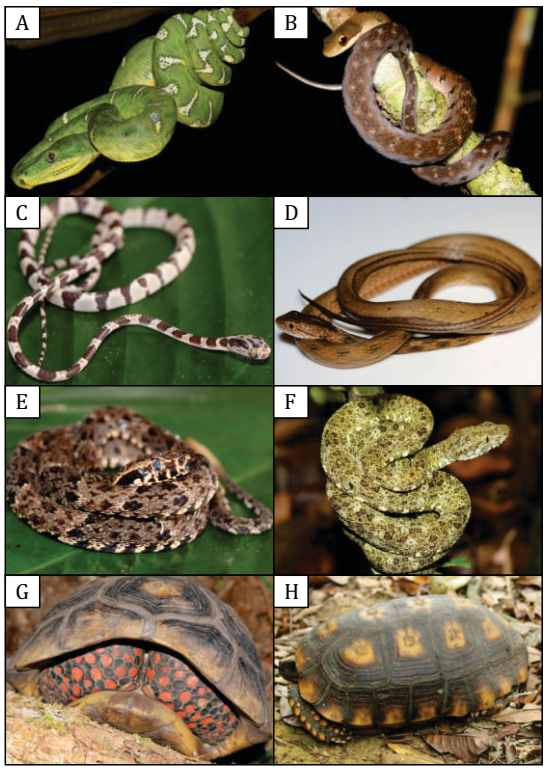

Figure 8. Reptile species recorded at ESEC Alto Maués, AM, Brazil. **A**. *Corallus batesii* **B**. *Erythrolamprus oligolepis*. **C**. *Imantodes cenchoa*. **D**. *Thamnodynastes pallidus*. **E**. *Bothrops atrox*. **F**. *Bothrops taeniatus*. **G**. *Chelonoidis carbonarius* **H**. *Chelonoidis denticulatus*. Photos by Anthony Ferreira.

Discussion

Given that the study area is in the transition zone between submontane forest and Amazonian lowlands, I expected a high diversity of amphibian and reptile species at ESEC Alto Maués, but I only recorded 36 species, a relatively small number compared to other localities across the Brazilian Amazonian (e.g., MACEDO et al., 2008; ÁVILA-PIRES et al., 2010; BERNARDE et al., 2011; FONSECA et al., 2019). The list is likely incomplete, as indicated by the species accumulation curves which failed to reach an asymptote. The total proportion of species unidentified at the time of the study was 16.6% (all frogs). These undetermined taxa were those for which I could not determine to the species level due to taxonomic uncertainties (e.g., inconsistencies in the taxonomy concerning a given group and/or insufficient material collected), as observed in other regions of the Amazon biome (see PADIAL; DE LA RIVA, 2009; FUNK et al., 2011; JANSEN et al., 2011; FERREIRA et al., 2017). All species recorded during this study, at least currently, are classified as least-concern (LC), the exceptions are the unidentified or newly-described species that have yet to undergo conservation status assessment.

It is very likely that the low herpetofaunal richness recorded is a consequence of the short duration of the assessment. Several anuran species widely-distributed across the Amazonian basin (e.g., *Rhinella marina* Linnaeus, 1758, *Leptodactylus knudseni* Heyer, 1972, *Lithodytes lineatus* Schneider, 1799, *Ceratophrys cornuta* Linnaeus, 1758, *Scinax ruber* Laurenti, 1768, *Dendropsophus minutus* Peters, 1872, *Boana cinerascens* Spix, 1824, *B. geographica* Spix, 1824, *Phyllomedusa vaillanti* Boulenger, 1882, *Callimedusa tomopterna* Cope, 1868) were not sampled in this inventory, but are likely to be encountered when new surveys in this region are carried out. The same is true for several species of snakes and lizards (e.g., *Plica umbra* Linnaeus, 1758, *Uranoscodon superciliosus* Linnaeus, 1758, *Norops fuscoauratus* D'Orbigny, 1837, *Ameiva ameiva* Linnaeus, 1758, *Typhlops reticulatus* Linnaeus, 1758, *Anilius scytale* Linnaeus, 1758, *Boa constrictor* Linnaeus, 1758, *Corallus hortulanus* Linnaeus, 1758, *Oxybelis aeneus* Wagler, 1824, *Spilotes pullatus* Linnaeus, 1758, *Erythrolamprus aesculapii* Linnaeus, 1758, *Micrurus lemniscatus* Linnaeus, 1758).

Typically, visual encounter surveys are the method that records the greatest number of herpetofauna species during short-term surveys, with arboreal species being almost exclusively recorded by this method (e.g., AVILA-PIRES et al., 2007; SIQUEIRA et al., 2009; PRUDENTE et al., 2010). I did not record species with fossorial, aquatic and semi-aquatic habits (except for *Paleosuchus trigonatus* Schneider, 1801, found in shallow streams within the forest). Usually, to encounter such species is necessary to conduct a targeted sampling that considers the specific lifestyle habits of this species group (e.g., funnel traps or other baited aquatic traps for aquatic chelonians and digging for subterranean species), as they can significantly increase the chances of capturing specimens for such taxa (FERREIRA et al., 2017). Although RIBEIRO-JÚNIOR et al. (2008) do not recommend the use of funnel traps in Neotropical forests because they consistently failed to capture more species of amphibians and reptiles.

For logistical reasons, I also did not use pitfall traps (a largely successful and effective method to capture amphibians and reptiles, see CAMPBELL; CHRISTMAN, 1982; CECHIN; MARTIN, 2000), which also contributed to the low number of species recorded in this study. The use of complementary techniques is highly recommended to obtain the most representative sample of the local fauna (ÁVILA-PIRES et al., 2007; FERREIRA et al., 2017), since individual techniques do not sample all environments or even all organisms in an environment. It is likely more species will be recorded at ESEC Alto Maués if the use of sampling methods specific for these taxa is applied in the field. In addition, comparisons between areas becomes difficult due to the different methods and sampling efforts employed by each area (see AZEVEDO-RAMOS; GALATTI, 2002; BERNARDE et al., 2012).

Several other localities inventoried across the Brazilian Amazonia differ in richness and composition of amphibian and reptile assemblages at local scales, some showing a high diversity compared to other localities. For example, Alter do Chão and Paragominas (AZEVEDO-RAMOS; GALATTI, 2002), Floresta Nacional do Trairão (MENDES-PINTO; SOUZA, 2011), Carajás region (PINHEIRO et al., 2012) and middle Rio Xingu (VAZ-SILVIA et al., 2015), both in Pará State, have 18, 30, 35, 71 and 109 amphibian species, respectively; while upper Juruá region - Reserva Extrativista do Alto Juruá and Serra do Divisor National Park (GASCON, 1996) and Reserva Extrativista Riozinho da Liberdade (BERNARDE et al., 2011), both in Acre State, have 126 and 83 amphibian species, respectively; intermediate Juruá river (GASCON, 1996), Boca do Acre (FRANÇA; VENÂNCIO, 2010) and Reserva Extrativista do rio Gregório (PANTOJA; FRAGA, 2012), both in Amazonas State, have 78, 56 and 46 amphibian species, respectively; and Cacoal region (TURCI; BERNARDE, 2008) and Guajará-Mirim (AZEVEDO-RAMOS; GALATTI, 2002), both in Rondônia State, have 17 and 56 amphibian species, respectively.

Due to the inventories of Amazonian reptiles carried out in new areas in the past few years, the knowledge of reptile species that occur in Amazonia has been constantly increasing. Reptile diversity in the region of Volta Grande do Xingu River in Pará state may be as high as 150 species, based on information obtained after five years (VAZ-SILVIA et al., 2015). Survey of squamata reptiles in municipality of Porto Walter (Juruá Valley, Acre State) reported 50 species (AVILA-PIRES et al., 2009); 59 reptilian species at Bacarena in Pará State (SILVA et al., 2011); 38 reptile species at Alto Alegre dos Parecis in Rondônia State (FERRÃO et al., 2012); 38 reptilian species at Reserva Extrativista do rio Gregório (PANTOJA; FRAGA, 2012). Lizard surveys in several areas in the Brazilian section of the Guiana Shield, indicate that the local richness ranges from 15 to 24 species (e.g., ÁVILA-PIRES et al., 2010; ILHA; DIXO, 2010; OLIVEIRA et al., 2014). FRAZÃO et al. (2020) compared snake assemblage composition in six areas in Amazonas State, sampling 70 species in total (average of 21 per site). More recently, FERREIRA et al. (2017) published a list of the species of amphibians and reptiles found in Floresta Nacional do Pau-Rosa (a federally protected area located next to ESEC Alto Maués; Fig. 1). They collected a total of 39 species of amphibians and 24 species of reptiles, sampling with pitfall traps (most animals collected), active search (150 hours) and occasional encounters. My list includes 16 species records that were not reported by FERREIRA et al. (2017).

We are still far from a robust understanding of the amphibian and reptile diversity present in the Brazilian Amazonia, with a fragmented database and speculative estimates (see AZEVEDO-RAMOS; GALATTI, 2002; ETEROVICK et al., 2005; SILVA et al., 2005; FERREIRA et al., 2017). On the other hand, it is widely known that variation in species composition and richness across sites can be a consequence of natural and/or historical causes (e.g., habitat availability, climatic differences, altitude, distance to the nearest stream, topographic, edaphic factors and different geological origins and ages) (SILVA et al., 2005; MENIN et al., 2007; ÁVILA-PIRES et al., 2010; WESSELINGH et al., 2010; ROJAS-AHUMADA et al., 2012; COLE et al., 2013), habitat disturbance caused by anthropogenic activities (e.g., PILLSBURY; MILLER, 2008; VERDADE et al., 2012; MENIN et al., 2019), or as an artifact of unequal sampling effort (AZEVEDO-RAMOS; GALATTI, 2002; FERREIRA et al., 2017; FONSECA et al., 2019).

Basic faunal survey studies can contribute substantially to essential baseline knowledge of species distributions and to the collection of data for the assessment of their conservation status. Record of the *Boana icamiaba* Peloso et al. 2018, a species recently described from scattered localities in the mid–lower Rio Madeira–Rio Tapajós and lower Rio Tapajós–Rio Xingu interfluves, of Pará State, Brazil (PELOSO et al., 2018), represents the first record for Amazonas State, extending its geographic distribution in 455 km east of the nearest known location. The dendrobatid *Adelphobates* aff. *quinquevittatus* Steindachner 1864 is known only from the upper Rio Madeira drainage of Rondônia and adjacent (southern) Brazilian Amazonia (CALDWELL; MYERS, 1990; RODRIGUES; AZEVEDO-RAMOS, 2014). The record of this species in the ESEC Alto Maués extends its known distribution in 675 km east of the previous southernmost record, in the state of Rondônia.

The low richness recorded in this study is probably related to the following critical factors: 1) season - the expedition took place in May, outside the rainy season, when precipitation is reduced, so limiting anuran activity (VENÂNCIO et al., 2014). Rainfall only

occurred on a few occasions; 2) collecting effort – this was 14 days of sampling by a single researcher, which is a challenging task. The recommended protocol for representative sampling Amazonian herpetofaunal communities involves intensive multi-groups studies lasting, a minimum of 30 days for amphibians (HEYER, 1988), while for snakes, at least two years are needed (BERNARDE et al., 2011; FRAGA et al., 2014); 3) sampling area – this consisted of two transects of approximately 5 km, a relatively small area, especially since the quantity of species tends to increase with increasing area (HUBBELL, 2001); 4) absence of pitfall traps - this technique mainly captures highly camouflaged terrestrial species that live in deep leaf-litter on the forest floor or those living below ground, characteristics of both life-styles reduce species visual search detectability.

Given the above, there are gaps in our Brazilian Amazonian herpetofauna knowledge. This first checklist of the herpetofauna from Estação Ecológica Alto Maués must be considered preliminary. However, it represents the major first step in the knowledge of the diversity of amphibians and reptiles in the area, which represents an important protected site in Brazilian Amazonia. A total of 36 species of amphibians and reptiles were found. The vegetation of ESEC Alto Maués is pristine and current conservation appears effective, a fact supported by records of several species that are both sensitive and restricted to undisturbed forest environments (e.g., *Allobates grillisimilis* Simões et al. 2014, *Boana icamiaba* Peloso et al. 2018, *Dendropsophus ozzyi* Orrico et al. 2014, *Bothrops taeniatus* Wagler 1824). Considering the surveys in Floresta Nacional do Pau-Rosa carried out by FERREIRA et al. (2017) and my own results for the ESEC Alto Maués, I am confident that other species distribution extensions and even new species will be found as the studies in the region continue. Therefore, I emphasize the need for medium to long-term inventories, including the use of additional and complementary trapping techniques to inventory the species in this poorly-known area in the Brazilian Amazonia, as well as understand population trends and develop effective conservation plans to safeguard the species present at ESEC Alto Maués.

Acknowledgments

The author is grateful to Chico Mendes Institute for Biodiversity Conservation (ICMBio), especially the manager Ana Paula de Oliveira Mendes for logistic and financial support for the expedition. I am grateful to Albertina Lima, Diego Ortiz and Miquéias Ferrão for help with identification of some species. Additional thanks to anonymous referee for suggestions during the review process. Finally, I wish to thank Larissa Queiroz, Fernando Carvalho, Flávia Nonato, Vanielle Vicente, Daniel Quedes, Cristian Mendonza, Paulo Cézar Barroso, Sheila Lima, Adriano Lima, Márcio Amaral and Marcelo Motta for companionship and assistance during the expedition.

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